POPULATION STATUS, BREEDING ECOLOGY AND HABITAT REQUIREMENTS OF THE LONG-BILLED CURLEW

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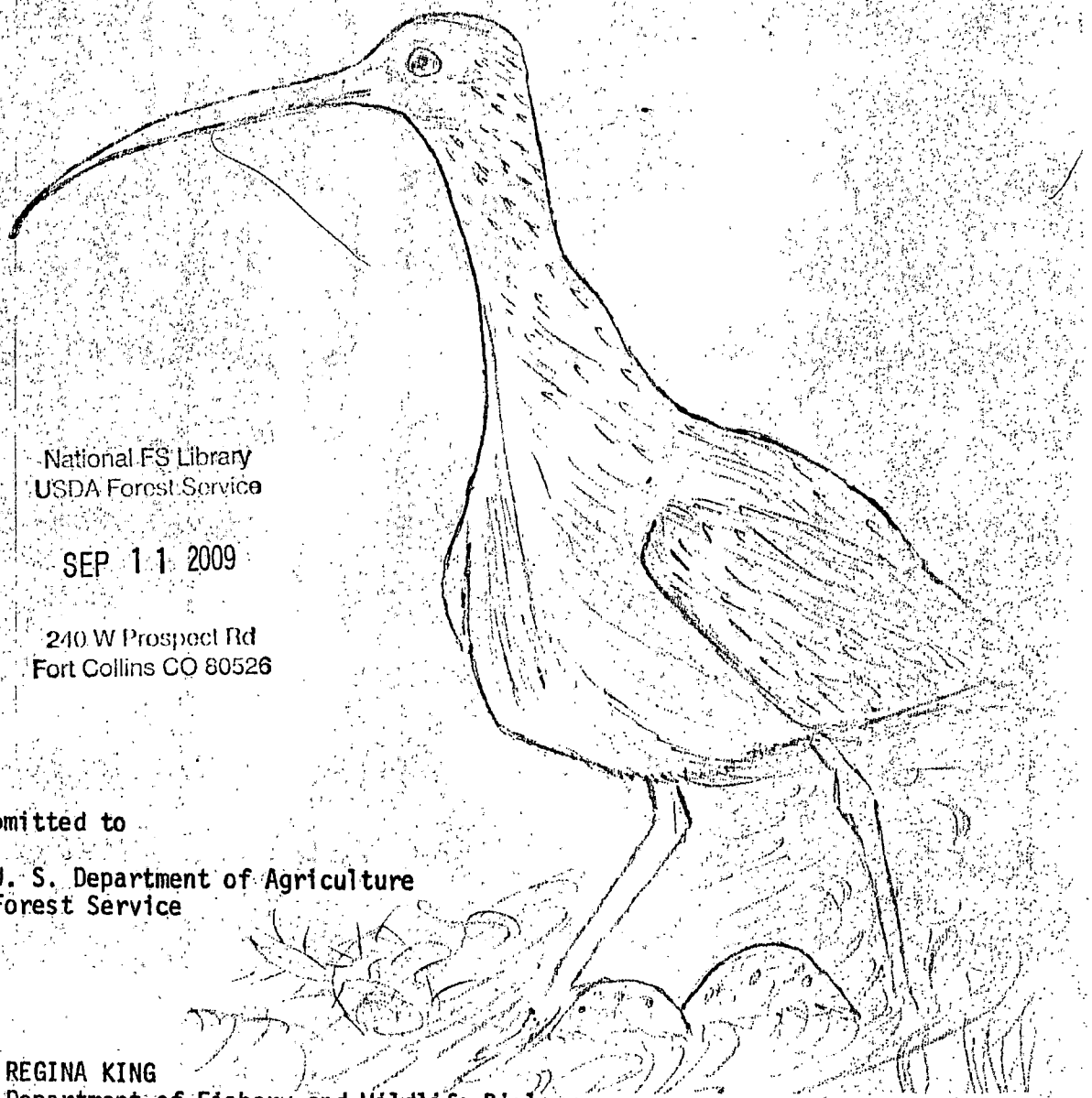

submitted to

U. S. Department of Agriculture
Forest Service

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Population Status, Breeding Ecology and Habitat Requirements of the Long-billed Curlew

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by

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This report is submitted in compliance with the specifications of Project 702-080-06 and contract with the U. S. Forest Service for the research services for gathering data on the population status, breeding ecology and habitat requirements of the Long-billed curlew (Numenius americanus) in Region 2.

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INTRODUCTION

Observations of the Long-billed curlew (Numenius americanus) were begun on May 13, 1977 on the Comanche National Grassland, Baca County, Colorado. Additionally, observations were made of the curlews breeding in Dallam and Hartley Counties, Texas, primarily on the Rita Blanca National Grassland and the Shamburger Ranch, Dallam County, Texas. Observation time was spent alternatively between the Colorado and Texas study areas until July 30. August 1 through August 15 was spent surveying and gathering information on the Ogalalla, Buffalo Gap and the Pawnee National Grasslands, which lie within the curlew's breeding range and which are reported to have breeding curlews. Reports of curlews sighted in these areas during the breeding season and notes on habitat use were collected from U.S. Forest Service personnel and from other area residents.

The results of the observations outlined above are presented in the following paper. In all, 166 field observations of curlews were made. Photographs are included as illustrations; additional photographs in the form of 35 mm color slides were placed on file with the U.S. Forest service office in Springfield, Colorado.

As required by contract, recommendations are included for habitat improvement which will (hopefully) result in the development of optimum conditions for curlews on the grasslands studied. However, it should be noted that these recommendations are made, with reservation, on the basis of a single field season's observations. Therefore, it is further

recommended that much additional work is needed on the problem of curlew populations and habitat before any action that is taken can be justified on an ecologically sound basis.

RESULTS

Population Size and Distribution. A record was kept of all curlews observed, including dates, numbers of birds, and location. This information is listed in Table 1 (see Appendix A) and on the maps in Appendix D. It appeared that during the breeding season, until about the third week in June, the birds tended to be seen habitually in the same areas. For this reason, the numbers on the maps indicate the greastest number of birds observed to be in that area. For the intensive study areas (Pastures 5B, 1B, Comanche National Grassland, South and North Morgan Pastures, Shamburger Ranch, and Unit 35, Rita Blanca National Grassland), this information is probably a fairly accurate estimate of population size for that particular area. However, the other sightings are only indicative of curlew distribution. The reason for this is that the majority of observation time was spent on the intensive study areas, and the remaining sightings are incidental or road-count data. Nonetheless, it can be seen from this data that southeastern Colorado and the northwestern Texas Panhandle do indeed have sizable breeding curlew populations. Supporting information may be found in the literature (Oberholser, 1974; Dillard, 1975; Graul, 1977).

The Breeding Season: Behavior, Nesting, and Young-rearing. By the time field work began, it was apparent that the curlews were already well into incubation of their eggs. This was expected from nesting dates listed in the literature (Bent, 1929; Bailey and Niedrach, 1967; Palmer, 1967). However, four nests were located, and the information

is presented in Table 3. Two of the four nests were located in wheat stubble fields and were discovered during plowing. One nest was destroyed due to the disturbance and the other is thought to have produced young (Figure 1, Appendix C.) The other two nests were both located in shortgrass prairie habitat, the main vegetation being mixed buffalo grass (Buchloe dactyloides) and blue grama grass (Bouteloua gracilis). One of these nests was destroyed when the eggs were smashed by a vehicle; the evidence at the fourth nest (Figure 2) indicated that the eggs were lost to avian predators, probably White-necked Ravens (Corvus cryptoleucus) which were common in the area.

Incubation was observed at one nest for one day. The male parent was incubating at the beginning of observation and continued to incubate for 2 hours and 20 minutes when he was relieved by the female. During that time the incubatng male was flushed from the nest once by a vehicle and once by cattle. Each time the bird remained on the nest, flattening itself to the ground, until the disturber was within 1 meter of the nest. At that time the bird jumped off the nest and exhibited a crippled display, with drooping wings, spread and lowered tail, and outstretched and lowered neck. At no time did the bird leave the nest area, and it returned to the nest as soon as the disturber began to move off and was less than 5 meters away. This behavior was also exhibited by a female that was flushed from a different nest (Figure 3). This behavior has been reported by others (Bent, 1929; Graul, 1971). As is noted in the literature (Silloway, 1900; Witherspoon, 1957; Graul, 1971), and as observed in this study, both sexes of adult curlews incubate the eggs.

The period of incubation was not able to be determined in this study, as egg laying was not observed. However, it is reported in the literature as about 28 to 30 days (Sugden, 1933; Graul, 1971; Forsythe, 1972). The first young curlew was observed in this study on May 27. This chick still had its egg tooth on the upper mandible and was therefore judged to be 2 days or less old (Forsythe, 1967). On this basis it is judged that the egg from which this chick was produced was laid April 26 - 28. This chick was captured and banded with a U.S. Fish and Wildlife Service aluminum leg band. It was weighed, measured (right tarsus and culmen length) and released. Throughout the summer, all young curlews that were captured were treated likewise. The data collected are presented in Table 2.(Figure 4).

As can be seen from the data, chicks of similar measurements and weights were found until about June 3. After the second week in June, all chicks found were of notably greater weight and size, indicating more advanced stages of growth. This data would seem to indicate that hatching takes place during the last week in May through the first week in June. This agrees with the dates for hatching reported in the literature (Bailey and Niedrach, 1967; Graul, 1971; Oberholser, 1974).

The young are reported to leave the nest within a few hours after hatching and are cared for by both adults (Bent, 1929; Witherspoon, L957; Graul, 1971). No dates for fledging could be found in the literature; in this study the first young curlew was seen flying on July 4. In agreement with the literature, most young curlews that were observed were in the presence of at least one adult curlew. Out of 32 observations of hatching-year curlews, only 4 observations were made of young curlews with no adults present. The first of these four instances

occurred on July 11, one week after the first fledgling was observed. Adults with young were observed as late as July 24.

Both the male and female adult curlew were observed with young throughout the young-rearing period. When the young were very small (approximately less than 2 weeks old), they dropped and remained motionless when alarm was signaled by the adults (presumably by call or flight patterns) (Figure 5). However, as the chicks grew older, they tended to attempt to run from the danger and dropped only when capture was imminent. The last chick that was captured ran until it was captured with an insect net (Figure 6). Even when capable of flight, the young seemed reluctant to fly and first attempted to escape by running.

From the end of May until mid-July, adult curlews commonly reacted to human disturbance by a "mobbing" type of behavior. This behavior was usually initiated by one or both members of a pair and consisted of flying up with an alarm call and swooping about the disturbance. In its extreme stages, mobbing included dives at the object causing the disturbance. Sometimes the alarmed pair were joined by other curlews of both sexes that were nearby (Figure 7). In addition to human disturbance, mobbing behavior was also elicited by White-necked Ravens, Swainson's Hawks (Buteo swainsoni), Ferruginous Hawks (Buteo regalis), Golden Eagles (Aquila chrysaetos), Turkey Vultures (Cathartes aura), coyotes (Canis latrans, and domestic dogs. Horses and cattle did not elicit this aggressive behavior from the curlews.

When the young were small, the male parent often exhibited "decoy" and/or the more persistent mobbing behavior. After some aggressive

behavior towards the threat, the female would often remain some distance away and was sometimes observed attempting to lead the young away from the danger. However, as the season progressed, the young were observed more often in the company of adult males and adult females were less commonly observed. In one instance, three adult females loafed and preened unconcernedly while an adult male with two chicks were pursued by a vehicle and one chick was captured.

Towards the end of June and during the first week of July, it was noticed that curlews that had been seen in the intensive study areas were gone. In general, fewer curlews were seen everywhere. On June 15, 105 adult curlews of both sexes where counted loafing near a windmill overflow in a shortgrass pasture on the Shamburger Ranch. (Figure 8). Residents of the area reported that as many as 50 curlews in a group had been seen less than four miles away several days earlier (C. Watts, pers. comm.) A search of the areas on June 16 revealed that the large group had gone. It is assumed from the large concentration of birds in one place and from their behavior that the birds were either resting during migration or flocking up in preparation for migration. No young of the year were observed with this group.

From a consideration of all factors stated above, it may be hypothesized that the majority of adult curlews of both sexes leave their breeding areas just about the time the first young are fledging, and that the young are left in the care of a few adult curlews, mostly males, and do not migrate south until later in the summer.

Habitat Use: Description of the Study Areas. The Comanche National Grassland lies within Baca County in the southeastern corner of Colorado. Its climate has been described as "semiarid...with an average total annual precipitation ranging from about 12 inches in the drier areas of the northwestern corner to above 17 inches on the eastern side." (Woodyard et. al, 1973). Periodic severe droughts and dustorms are common.

In 1973, slightly more than one-half of Baca County is reported to have been used for agricultural crops, with 818,000 acres dryfarmed (mostly winter wheat) and 20,000 acres irrigated (winter wheat and grain sorghum). The remaining one-half of Baca County exists as rangeland, with cattle as the main livestock (Woodyard, et. al, 1973).

Vegetation on the hardlands consists of a mixture of mid and short grasses, predominently blue grama and buffalo grass. Poor range conditions are indicated by an increase of threeawn (Aristida spp.), sand dropseed (Sporobolus cryptandrus), wild alfalfa (Psoralea tennuiflora), pricklypear cactus (Opuntia spp.), snakeweed (Gutierrezia sarothrae), and ring muhly (Muhlenbergia torreyi). On the sandy soils the vegetation consists of sideoats grama (Bouteloua curtopendula), blue grama, yellow indiangrass (Sorgastrum nutans), and sand dropseed. Poor range conditions on sandy soils are indicated by an increase of yucca (Yucca glauca), sand sage (Artemisia filifolia), sand dropseed and inland saltgrass (Distichlis stricta) (Woodyard et. al, 1973). However, the condition, abundance and types of vegetation on the range may vary depending upon soil and moisture conditions and past and present grazing practices.

The Rita Blanca National Grassland and the Shamburger Ranch are located in Dallam County in the northwestern Texas Panhandle. Dallam

County is less than 100 miles south of Baca County, Colorado, and its climate is very similar, with an average total annual precipitation of 16 inches. Droughts and dustorms are common.

In 1975, one-half of the acreage in Dallam County is reported to have been use for agricultural crops, mostly winter wheat and grain sorghums. Roughly two-fifths of this acreage is irrigated and three-fifths is dryfarmed. The remaining one-half (500,000 acres) of the land in Dallam County is rangeland, with the main livestock being cattle. (Ford and Fox, 1975; Soil Conservation Service, Dalhart, pers. comm.).

As in Baca County, two general types of grassland predominate in Dallam County: the sandy soils with mid and tall grasses and the hardland soils with short grasses. Vegetation species on these soils is similar to that described for these soils in Baca County.

Habitat Use: Vegetation. Table 4 summarizes the results of curlew observations in relation to vegetation types. In 72.3 percent of the total number of observations, curlews were seen on what is called shortgrass prairie habitat with the main vegetation being mixed buffalo grass and blue grama grass (Figure 9). At lease one other vegetation species was usually present in the immediate area of observation. These other species are listed in the table in the column at the far right. The importance of these species is not known, but either shade or protective cover was sought by the curlews in the following species: Sand sage, silver bluestem (Bothriochloa saccharoides), plains wallflower (Erysimum sp.), snakeweed, goldenweed (Haplopappus spinulosus), sneezeweed (Helenium tenuifolium), prairie sunflower (Helianthus petiolaris), foxtail barley (Hordeum jubatum), wild alfalfa, yellow clover (Trifolium procumbens), and yucca (Figures 8-13).

Curlews were not always observed in strictly shortgrass habitat (Figures 8, 10, 13, 14). Twelve percent of the observations were of curlews in threeawn, which is classified as a mid-grass and is indicative of a disturbed area. Figure 13 shows a curlew in a dense stand of squirreltail, another mid-grass indicative of disturbed areas. An abundance of forbs is also characteristic of a disturbed grassland situation (Woodyard, 1973), and curlews were observed in areas heavily covered with forbs (Figures 11 and 12). Furthermore, of all observations made, curlews were observed 10.8 percent of the time in agricultural crops.

Young curlews were observed 65.6 percent of the time in buffalo-blue grama grass habitat, and 18.7 percent of the time in agricultural crop situations.

As shown in Table 3, and as previously stated, only four nests were found. Two nests were in buffalo-blue grama grass vegetation, and two were in wheat stubble fields.

Habitat Use: Water. Although curlews breed in a prairie grassland habitat, they are shorebirds and it may be that water is a factor in their breeding distribution and success. Table 5 shows the number of curlew observations in relation to the distance to standing water. The information was not always obvious, and the distances are approximate at best. Although only 5.4 percent of the observations were of curlews at or at standing water, 39.2 percent were within $\frac{1}{4}$ mile of standing water. The table shows that the number of curlew observations become less as the distance to standing water increases. Natural standing water on the prairie is scarce and sporadic, and in most

cases standing water was in the form of windmill overflow, stockponds, dugouts or irrigations water.

Habitat Use: Feeding. Curlews were observed feeding in all of the vegetation types listed in Table 4. Feeding was difficult to observe, as the curlews seldom behaved in a normal fashion when a human observer was close enough to accurately observe feeding habits. However, it was noted that curlews often fed in small groups, usually working in the same general direction, either in a front or in a line formation. Prey capture was most typically by a quick jabbing movement of the bill at the ground surface. The prey was captured by the tip of the bill and then traveled quickly up the bill and into the mouth.

Curlews are reported as mainly insectivorous (Wickersham, 1902; Bugden, 1933; Palmer, 1967). The only prey item that was positively identified in this study is the grasshopper, which seemed to be plentiful in all habitat types throughout most of the season.

Survey of the Other Grasslands. During the first weeks of August, three other prairie grassland areas were briefly surveyed: the Ogalalla National Grassland near Chadron, Nebraska, the eastern Buffalo Gap National Grassland near Wall, South Dakota and the western Buffalo Gap National Grassland near Hot Springs, South Dakota, and the Pawnee National Grassland near Greeley, Colorado. No curlews were observed during the surveys, as the birds had already left for their wintering grounds. However, the habitat where curlews had been observed during the breeding season were visited with the assistance of Forest Service personnel.

On the Pawnee National Grasslands, Forest Service personnel (G. Adams, pers. comm.) reported only four curlew observations in the past four years. Most of these birds were seen in buffalo-blue grama grass habitat and several were observed in agricultural crops.

Forest Service personnel on the other grasslands reported similar observations, with the exception that the vegetation in which the curlews were seen on the Buffalo Gap and the Ogalalla National Grasslands was predominately western wheatgrass (Agropyron smithii) with buffalo-blue grama grass as a secondary species complex.

Other differences that were noted between these grasslands and the main study areas of this project were the amount of agricultural and rangeland and the available sources of standing water. In the areas of all three of these grasslands, agriculture is much less intense than in the main study areas of the project. The majority of the land is used by man as rangeland for grazing cattle. The degree of grazing and the condition of the range varies with location, as does

the source of water supply. On the Buffalo Gap National Grassland stock-watering is achieved mostly through the use of stockponds and dugouts. On the Ogalalla National Grassland stock-watering is achieved by stocktanks equipped with float valves and fed through a pipeline system. On the Pawnee National Grassland a combination of windmills with overflows and pipeline-fed stocktanks. Water from all these methods of stock watering is available for use by curlews except for the tanks with the float valves which prevents any water from spilling over the sides of the tank. However, all Forest Service personnel on these grasslands who were questioned and other area residents aware of curlew activity noted that although curlews were not often observed very far from water, the birds were seldom seen to actually use the water. This agrees with the observations made in this study.

CONCLUSIONS AND RECOMMENDATIONS

The first and foremost conclusion resulting from this study is that far too little is known of the basic biology and ecology of the Long-billed curlew and that much additional study is needed before any recommendations can be justified on a scientific basis. However, the following are some conclusions and recommendations based on the preliminary results of this project.

The present total Long-billed curlew population is probably far less than it once was. This may be due to several factors, including former market hunting, the reduction of available prairie breeding habitat due to agriculture and other human use, and possibly natural shifts in the species' environment. There seems to be much available shortgrass prairie habitat from the Dakotas south to Texas that is unused by curlews, while other areas such as those studied in this project have concentrations of breeding curlews. The reason(s) for this discrepancy have not yet been worked out; however, the differences in vegetation and water availability as described above may be linked to problem. It is therefore possible that increasing the availability of water may have a favorable effect on the population size and distribution of breeding curlews.

Based on the vegetation data presented here, it is also likely that diversity in the habitat vegetation is a factor in the curlew's ecology. Since the birds were observed to use a variety of different

vegetation types, it may be advisable that variety in vegetation types be available to the birds.

It appears from observations in this study that cattle are little or no threat to breeding curlews, and that the birds may be trying to adapt to the ever-growing agricultural situation. However, notable decline in curlew numbers have occurred since former times and it is more probable that the birds are more successful on historical native range land. It is therefore recommended that further agricultural development be discouraged while properly controlled grazing practices be encouraged.

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Appendix A

TABLES

TABLE 1: Record of Curlew Observations *

Date	Location	Number of birds	Vegetation species	Distance to water (in miles)
5-13	CNG	1 A	Buda, bogr, Yugl	> 1
"	"	4 A	Arfi, Buda, Bogr	> 1
"	"	2 A	Buda, Bogr	> 1
"	"	1 A	Buda, Bogr	< ½
"	"	1 A	Buda, Bogr, Agsm	in playa
5-14	"	1 A	Wheatfield	< ¼
"	"	2 A	Wheatfield	< 1
"	"	1 A	Stubble field	> 1
"	"	1 A	Wheatfield	> 1
"	"	6 A	Wheatfield	< ½
5-15	"	1 A	Buda, Bogr	< ¼
"	"	1 A	Buda, Bogr	> 1
"	"	2 A	Buda, Bogr, Yugl	< ¼
"	RBNG	5 A	Buda, Bogr, Agsm	in playa
"	"	1 A	Buda, Bogr, Hete	< 1
"	"	1 A	Buda, Bogr, Agsm	< ¼
5-16	SR	2 A	Buda, Bogr	< ½
5-17	"	2 A	Buda, Bogr	< ¼
"	RBNG	2 A	Buda, Bogr	< 1
"	SR	1 A	Wheatfield	< 1
"	"	1 A	Buda, Bogr	< ¼
5-18	P-R	1 A	Arfi, Buda, Bogr	< ½
"	"	1 A	Buda, Bogr	unknown
"	"	2 A	Buda, Bogr	< ¼
5-24	CNG	6 A	Arlo, Buda, Bogr	< ¼
"	"	5 A	Wheatfield	< ½
"	"	1 A	Buda, Bogr, Gusa	< 1
5-26	"	1 A	Buda, Bogr, Arlo	< ½
"	"	6 A	Buda, Bogr	< ½
"	"	1 A	Agsm, Buda, Bogr	< ½
"	"	2 A	Buda, Bogr	< ½
"	"	1 A	Buda, Bogr, Agsm	in playa
5-27	"	3 A	Buda, Bogr, Arlo	< ¼
"	"	1 A	Agsm, Trpr, Buda	< 1
"	"	1 A	Agsm, Buda, Bogr	< 1
"	"	4 A	Buda, Bogr	> 1
"	"	4 A, 1 HY	Buda, Bogr, Er sp.	< ¼
"	"	3 A	Buda, Bogr	< ¼
"	"	1 A	Buda, Bogr	< ¼
5-28	RBNG	2 A	Buda, Bogr, Arlo	< 1
"	"	4 A	Buda, Bogr, Hete	< 1
"	"	5 A	Buda, Bogr, Agsm	< ¼
"	"	7 A	Buda, Bogr, Agsm	< ¼
"	P-R	1 A	Buda, Bogr	in playa

TABLE 1, continued

Date	Location	Number of birds	Vegetation species	Distance to water (in miles)
5-28	P-R	2 A	Buda, Bogr	unknown
"	"	2 A	Buda, Bogr	unknown
"	"	2 A	Buda, Bogr, Agsm	unknown
"	"	13 A	Buda, Bogr	unknown
"	"	5 A	Buda, Bogr, Agsm	in stockpond
"	"	4 A	Buda, Bogr	unknown
5-29	RBNG	6 A	Buda, Bogr, Arlo	$<\frac{1}{2}$
"	"	4 A	Arlo, Buda, Bogr	<1
5-30	"	? A	Buda, Bogr	<1
"	"	? A	Arlo, Buda, Bogr	<1
"	"	3 A, 3 HY	Hete, Buda, Bogr	>1
"	"	? A	Arlo, Buda, Bogr	<1
5-31	SR	6 A	Buda, Bogr, Agsm	$<\frac{1}{2}$
"	"	? A	Buda, Bogr	>1
"	RBNG	1 A	Buda, Bogr, Agsm	<1
6-1	P-R	1 A	Buda, Bogr	unknown
"	RBNG	? A	Buda, Bogr, Agsm	<1
"	"	1 A	Arlo, Buda, Bogr	<1
"	"	1 A	Arlo, Buda, Bogr	<1
"	"	? A	Buda, Bogr	>1
"	P-R	? A	Buda, Bogr	$<\frac{1}{2}$
"	"	1 A	Buda, Bogr, Arlo	$<\frac{1}{2}$
6-2	"	? A, 1 HY	Buda, Bogr	$<\frac{1}{2}$
"	"	6 A, ? HY	Buda, Bogr, Hasp	$<\frac{1}{2}$
"	"	1 A	Buda, Bogr, Hasp	unknown
"	"	3 A	Buda, Bogr, Agsm	at stockpond
"	"	? A	Buda, Bogr	unknown
6-3	CNG	1 A	Buda, Bogr, Arlo	>1
"	"	? A, 1 HY	Buda, Bogr	$<\frac{1}{4}$
"	"	? A	Buda, Bogr, Arlo	$<\frac{1}{4}$
"	"	? A	Arlo, Agsm	$<\frac{1}{4}$
"	"	? A	Buda, Bogr	$<\frac{1}{4}$
"	"	? A	Buda, Bogr, Agsm	$<\frac{1}{4}$
"	"	? A	Arlo, Buda, Bogr	$<\frac{1}{4}$
6-4	"	? A	Buda, Bogr	$<\frac{1}{4}$
"	"	4 A	Arlo, Buda, Bogr	$<\frac{1}{4}$
"	"	? A	Buda, Bogr, Agsm	$<\frac{1}{4}$
"	"	? A	Buda, Bogr, Yugl	$<\frac{1}{2}$
6-5	"	4 A	Wheat stubble	$<\frac{1}{2}$
"	"	? A	Wheatfield	$<\frac{1}{2}$
"	"	? A	Arlo, Sihy Trpr	<1
"	"	4 A	Arlo, Buda, Bogr	$<\frac{1}{4}$
"	"	? A	Buda, Bogr	$<\frac{1}{4}$
"	"	6 A	Arlo, Sihy, Feoc	$<\frac{1}{2}$
"	"	? A	Buda, Bogr, Arfi	<1

Table 1, continued

Date	Location	Number of birds	Vegetation species	Distance to water (in miles)
6-5	CNG	9 A	Arlo, Buda, Bogr	< ¼
"	"	2 A	Bogr, Buda	< 1
6-6	"	? A	Buda, Bogr, Yugl	< ¼
"	"	10 A	Buda, Bogr, Agsm	< 1
6-8	"	1 A	Wheat stubble	> 1
"	"	3 A, 1 HY	Arlo, Sihy, Muto	< ¼
6-9	"	6 A, 1 HY	Buda, Bogr, Yugl	< ¼
"	"	4 A, 1 HY	Buda, Bogr	< ¼
6-10	"	1 A	Buda, Bogr	< ¼
"	"	6 A	Agsm, Arlo, Hepe	< ½
"	"	1 A, 1 HY	Arlo, Buda, Bogr	< ½
"	"	4 A, 1 HY	Buda, Bogr, Feoc	< ½
6-12	"	12 A	Buda, Bogr, Yugl	< ½
"	"	2 A	Agsm, Sper	< ¼
6-13	RBNG	1 A	Buda, Bogr	> 1
"	"	? A	Buda, Bogr, Agsm	> 1
"	"	? A	Arlo, Buda, Bogr	< 1
"	"	2 A	Buda, Bogr	< 1
6-14	SR	1 A	Buda, Bogr	> 1
"	"	7 A	Buda, Bogr, Agsm	< ½
"	"	1 A, ? A	Buda, Bogr	< ¼
"	"	4 A	Buda, Bogr	< ¼
"	"	8 A	Buda, Bogr	< ¼
"	"	1 A	Buda, Bogr	< ¼
"	"	? A	Buda, Bogr	< ¼
"	"	50 A	Buda, Bogr	< ¼
6-15	"	105 A	Buda, Bogr Pste	< ¼
6-16	"	? A	Buda, Bogr	< ¼
"	"	4 A	Buda, Bogr	< ¼
"	"	6 A	Buda, Bogr, Agsm	< ½
"	"	1 A, ? HY	Buda, Bogr	< ¼
"	"	6 A, ? HY	Buda, Bogr	< ¼
"	"	? A	Buda, Bogr	< ¼
"	"	? A	Buda, Bogr	< ¼
6-17	RBNG	13 A	Buda, Bogr	< ½
6-20	CNG	? A	Buda, Bogr, Agsm	< ¼
"	"	8 A	Arlo, Sihy, Buda	< ¼
"	"	? A, ? HY	Buda, Bogr	< ¼
6-22	RBNG	? A	Buda, Bogr	< ¼
"	SR	6 A	Buda, Bogr	< ¼
6-23	CNG	? A	Wheat stubble	< ¼
6-25	"	1 A	Bogr, Hepe, Arfi	> 1
"	"	1 A	Buda, Bogr	< ½
"	"	2 A	cut wheat	< ½
"	"	? A, 1 HY	maize	< ¼

TABLE 1, continued

Date	Location	Number of birds	Vegetation species	Distance to water (in miles)
6-26	CMG	8 A	Arlo, Arfi, Pste	$<\frac{1}{4}$
6-27	"	2 A, 2 HY	sorghum, Hepe	<1
"	"	4 A, 2 HY	Buda, Bogr	$<\frac{1}{2}$
"	"	2 A, 5 HY	Hepe, maize	$<\frac{1}{4}$
6-28	"	3 A	Buda, Bogr, Yugl	$<\frac{1}{4}$
"	"	1 A	Bosa, Arlo, Pste	$<\frac{1}{4}$
"	"	2 A	Buda, Bogr	$<\frac{1}{4}$
6-29	"	2 A	Buda, Bogr, Arfi	<1
6-30	"	1 A, 3 HY	Bogr, Arfi, Pste	>1
7-1	"	2 A	Buda, Bogr	$<\frac{1}{4}$
"	"	1 A, 2 HY	Arlo, Buda, Bogr	$<\frac{1}{4}$
"	"	2 A	Buda, Bogr, Arfi	$<\frac{1}{4}$
"	"	2 A	Buda, Bogr, Arfi	$<\frac{1}{4}$
7-3	"	1 A	Buda, Bogr	$<\frac{1}{4}$
"	"	2 A, 1 HY	Buda, Bogr, Arfi	$<\frac{1}{4}$
7-4	"	1 A, 1 HY	cut wheat	>1
7-6	"	3 A, 7 HY	Bogr, Arfi, Hepe	>1
7-7	RBNG	1 A	Buda, Bogr	$<\frac{1}{4}$
"	"	10 A	Arlo, Buda, Bogr	$<\frac{1}{4}$
7-8	SA	1 A, 1 HY	Buda, Bogr	$<\frac{1}{4}$
7-10	CMG	3 A, 5 HY	Buda, Bogr	$<\frac{1}{4}$
"	"	2 A	Buda, Bogr	$<\frac{1}{4}$
7-11	"	1 A, 2 HY	cut wheat	<1
"	"	1 HY	cut wheat	>1
7-20	"	4 HY	Buda, Bogr, Yugl	$<\frac{1}{4}$
7-21	"	1 HY	Bogr	>1
7-22	"	3 HY	Bogr	$<\frac{1}{4}$
"	"	3 A, 14 HY	Buda, Bogr	$<\frac{1}{2}$
7-23	"	1 A	Buda, Bogr	>1
7-24	"	7 A, 4 HY	Buda, Bogr	$<\frac{1}{2}$
"	"	1 A	Buda, Bogr, Agsm,	$<\frac{1}{4}$
7-25	"	1 A	Buda, Bogr, Arfi	$<\frac{1}{4}$

*See Appendix B for abbreviations.

TABLE 2: Weights and Measurements of Curlew Chicks

Date	Location	Band number	Weight (g)	Tarsus length (mm)	Culmen length (mm)
5-27	CO	401	55.0	49.0	24.0
5-30	TX	402	49.0	45.0	21.0
"	TX	403	55.0	47.0	23.0
"	TX	404	52.0	52.5	24.0
6-2	TX	405	51.0	53.0	24.5
"	TX	406	94.0	60.0	31.0
"	TX	407	66.0	59.0	26.0
6-3	CO	408	48.0	47.5	22.0
6-9	CO	409	165.0	70.5	32.0
6-10	CO	410	110.0	65.0	33.0
"	CO	411	170.0	73.0	39.0
6-14	TX	412	240.0	85.0	46.0
6-16	TX	413	320.0	88.5	51.0
"	TX	414	350.0	93.0	47.0
"	TX	415	310.0	91.0	46.0
6-27	CO	416	614.0	104.0	85.0
"	CO	417	354.0	93.0	53.0
7-3	CO	418	569.0	112.0	83.0
7-6	CO	419	414.0	94.0	66.0

TABLE 3: Information Collected on Curlew Nests*

Nest	Date	Location	Vegetation	Number of eggs	Description of nest	Fate of nest
1	5-26	T33, R47 S21, NW¼ Baca Co., CO	Buda, Bogr	Unknown	Shallow scrape; filled with bits of dried cow manure; next to cow manure pile.	Eggs smashed by vehicle.
2	5-26	T33, R48 S11, SW¼ Baca Co., CO	Wheat stubble	4	Shallow scrape; lined with small sticks, grasses and wheat stems.	Plowed over; eggs probably taken by mammalian predator.
3	6-14	Bryan Pasture, Shamburger Ranch Dallam Co., TX	Buda, Bogr	4	Shallow scrape; lined with pieces of corn stalks and grasses; next to cow manure pile.	Eggs lost to avian predation; probably White-necked Ravens.
4	6-23	T33, R47 S22, SW¼ Baca Co., CO	Wheat stubble	4	Shallow scrape lined with wheat stems and other small sticks.	Evidence indicates nest probably produced young.

* See Appendix B for abbreviations.

TABLE 4: Curlew Observations in Relation to Vegetation.*

Number of curlew observations	Number of observations of young curlews	Main vegetation species	Other vegetation species commonly present	
120 (72.3%)	21 (65.6%)	Buda, Bogr	Agsm Arfi Arlo Dist Er sp. Feoc Gusa	Hasp Hepo Hoto Muto Psto Sihy Yugl
20 (12.0%)	2 (6.2%)	Arlo	Agsm Arfi Bogr Buda Feoc Muto	Opar Psto Sihy Sper Trpr Yugl
18 (10.8%)	6 (18.7%)	Wheat, wheat stubble, maize, sorghum or roadway		
5 (3.0%)	0 -	Agsm	Bogr Buda Dist Sper Trpr	
2 (1.2%)	0 -	Arfi	Bogr Buda	
1 (0.6%)	0 -	Rosa	Arlo Psat	

*See Appendix B for abbreviations.

TABLE 5: Curlew Observations in Relations to Standing Water.

	Distance to water in miles					
	in or at water	$< \frac{1}{4}$	$< \frac{1}{2}$ but $> \frac{1}{4}$	< 1 but $> \frac{1}{2}$	< 1	unknown
Number of observations in Colorado	4	44	20	11	13	5
Number of observations in Texas	5	21	11	13	7	13
Number of observations of young curlews	1	16	7	2	6	0
Percentage	3.1	50.0	21.9	6.2	18.8	-
Total number of observations	9	65	31	24	20	18
Percentage	5.4	39.2	18.7	14.5	12.0	10.8

Appendix B

ABBREVIATIONS

Abbreviations to Scientific Names of Plants.

Abbreviation	Scientific Name	Common Name
Agsm	Agropryon smithii	Western wheatgrass
Arfi	Artemisia filifolia	Sand sage
Arlo	Aristida longiseta	Red threeawn
Bogr	Bouteloua gracilis	Blue grama
Bosa	Bothriochloa saccharoides	Silver bluestem
Buda	Buchloe dactyloides	Buffalo grass
Dist	Distichlis stricta	Inland saltgrass
Er sp.	Erysimum sp.	Plains wallflower
Feoc	Festuca octoflora	Sixweeks fescue
Gusa	Gutierrizia sarothrae	Snakeweed
Hasp	Haplopappus spinulosus	Goldenweed
Hepe	Helianthus petiolaris	Prairie sunflower
Heto	Helenium tenuifolium	Sneezeweed
Muto	Muhlenbergia torreyi	Ring muhly
Op sp.	Opuntia sp.	Pricklypear cactus
Opar	Opuntia arborescens	Cholla cactus
Pste	Psoralea tennuiflora	Slimstem scurfpea
Sihy	Sitanion hystrix	Bottlebrush squirreltail
Spcr	Sporobolus cryptandrus	Sand dropseed
Trpr	Trifolium procumbens	Yellow clover
Yugl	Yucca glauca	Yucca

Other Abbreviations

A	Adult
CNG	Comanche National Grassland
CO	Colorado
HY	Hatching year
P-R	Proctor-Reynolds Ranches
RBNG	Rita Blanca National Grassland
SR	Shamburger Ranch
TX	Texas

Appendix C

PHOTOGRAPHS

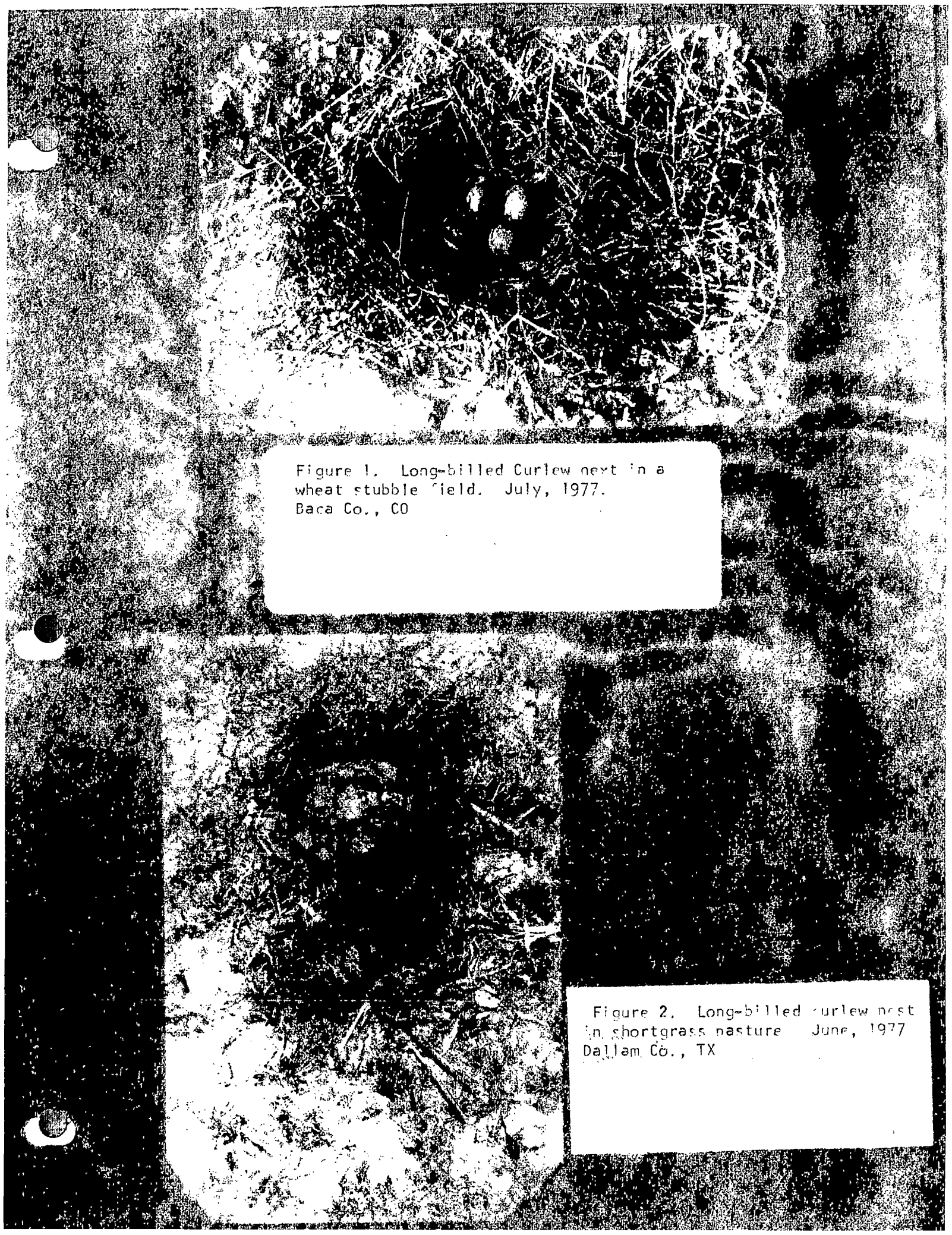


Figure 1. Long-billed Curlew next in a wheat stubble field. July, 1977. Baca Co., CO

Figure 2. Long-billed Curlew nest in shortgrass pasture. June, 1977 Dallam Co., TX

Figure 3. Crippled display by female curlew upon being flushed from her nest. July, 1977. Baca Co., CO.

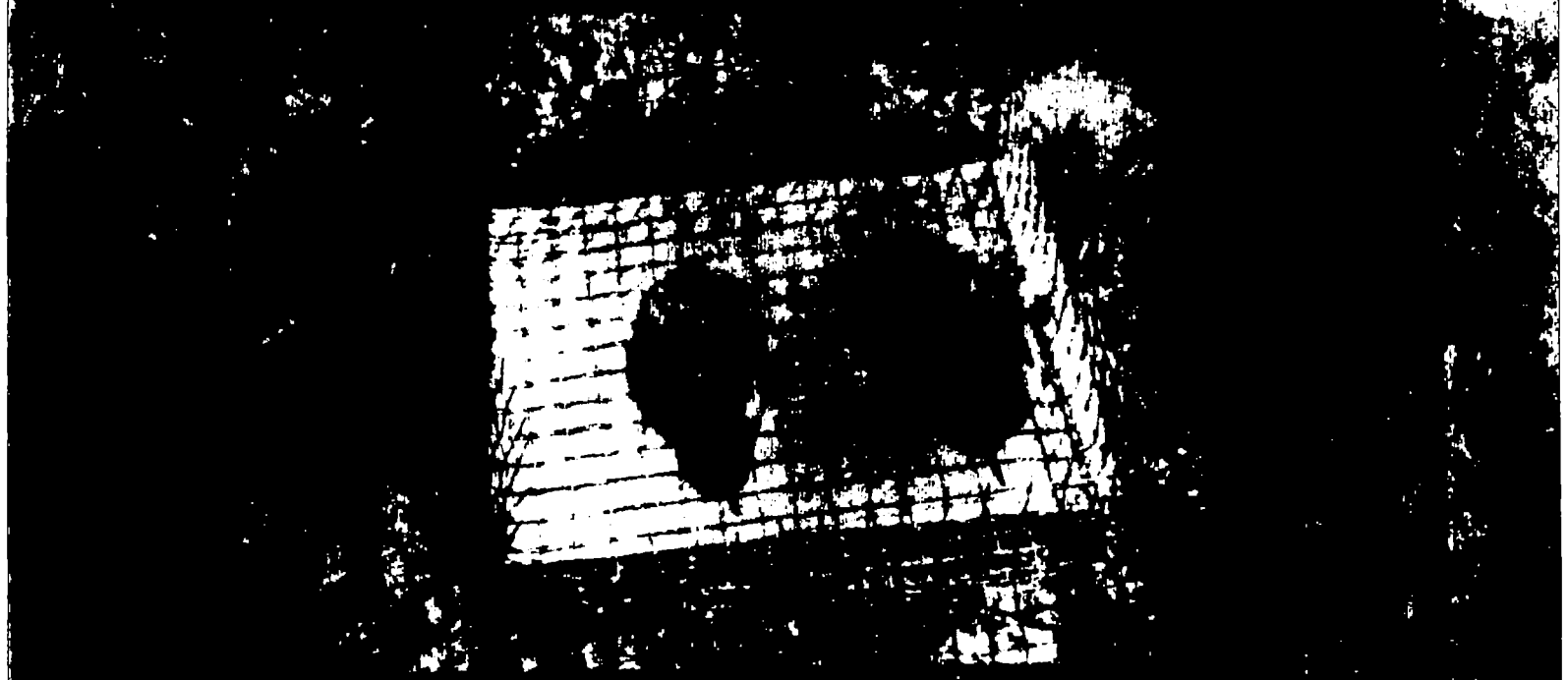
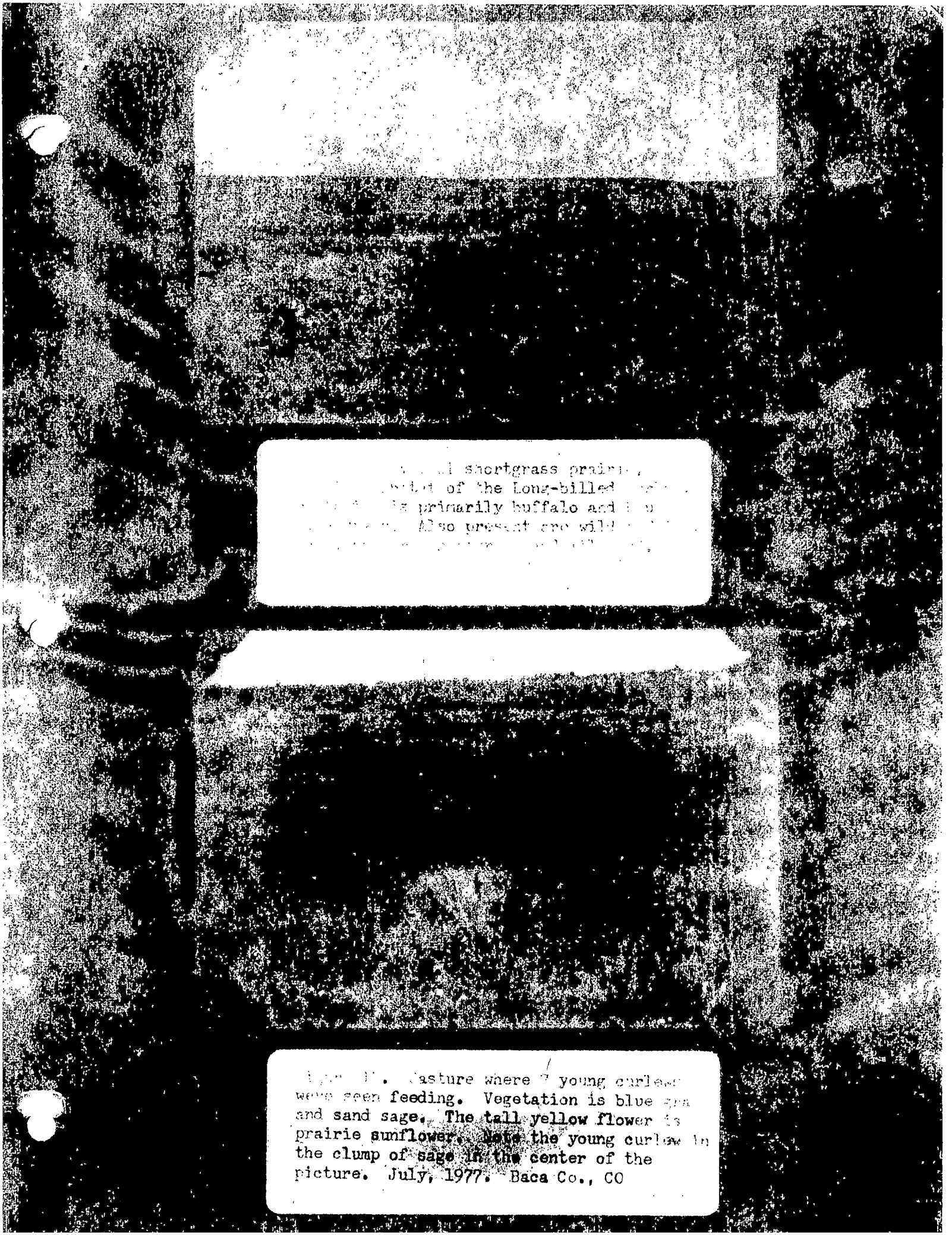


Figure 4. Sibling curlews, less than 2 days old. May, 1977, Dallam Co., TX

Figure 5. Curlew chick where it dropped when pursued by humans. Vegetation is buffalo and blue grama grass and sixweeks fescue. Note the pile of dried cow [illegible], 1977. Baca Co., CO.

Figure 6. Curlew chick, approximately one month old, which ran when pursued until captured with an insect net. July, 1977. Baca Co., CO.



...l shortgrass prairie ...
...bitat of the Long-billed ...
...is primarily buffalo and ...
... Also present are wild ...

...igure 11. Pasture where 2 young curlews were seen feeding. Vegetation is blue gra... and sand sage. The tall yellow flower is prairie sunflower. Note the young curlew in the clump of sage in the center of the picture. July, 1977. Baca Co., CO

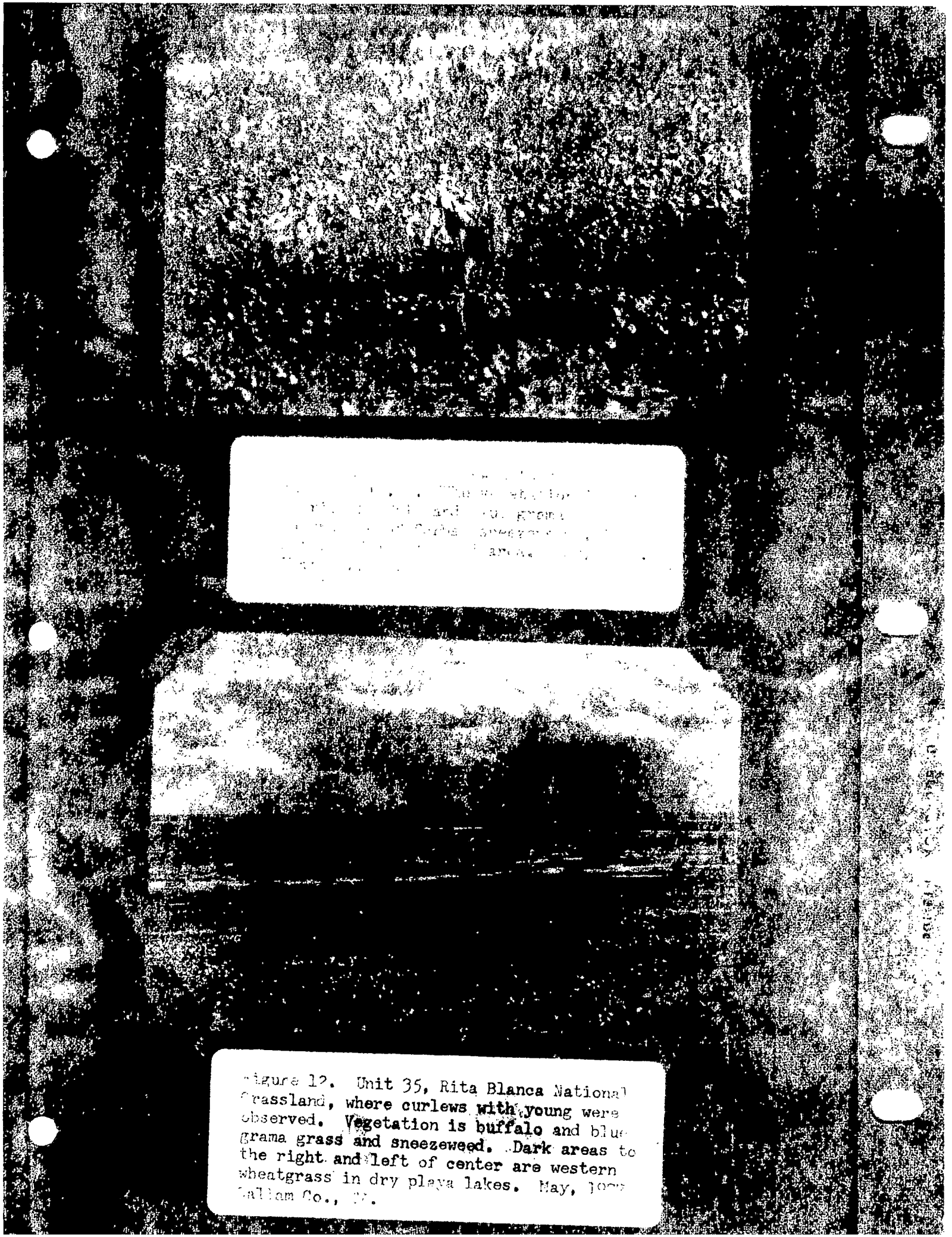


Figure 12. Unit 35, Rita Blanca National Grassland, where curlews with young were observed. Vegetation is buffalo and blue grama grass and sneezeweed. Dark areas to the right and left of center are western wheatgrass in dry playa lakes. May, [illegible] Dallam Co., Tx.

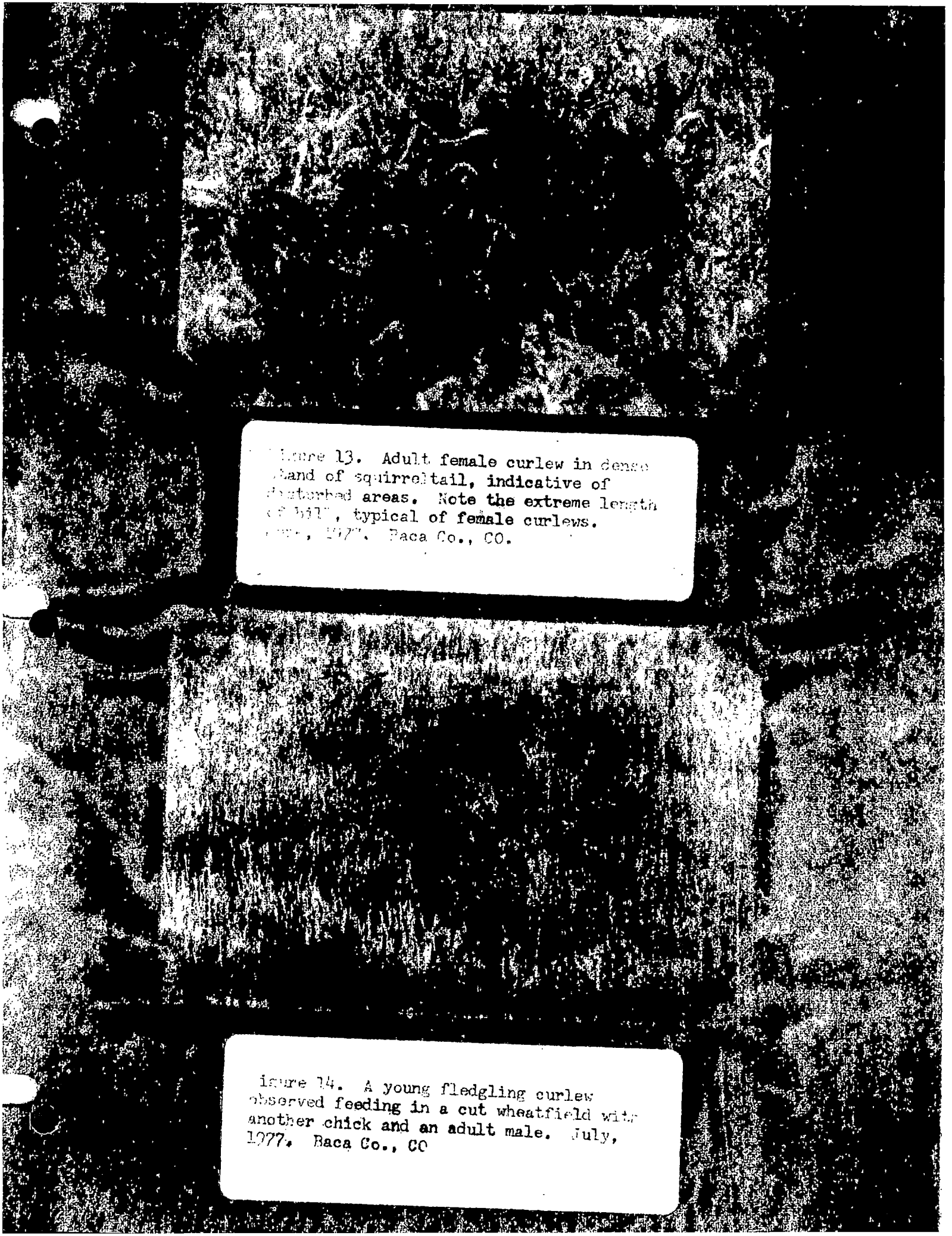
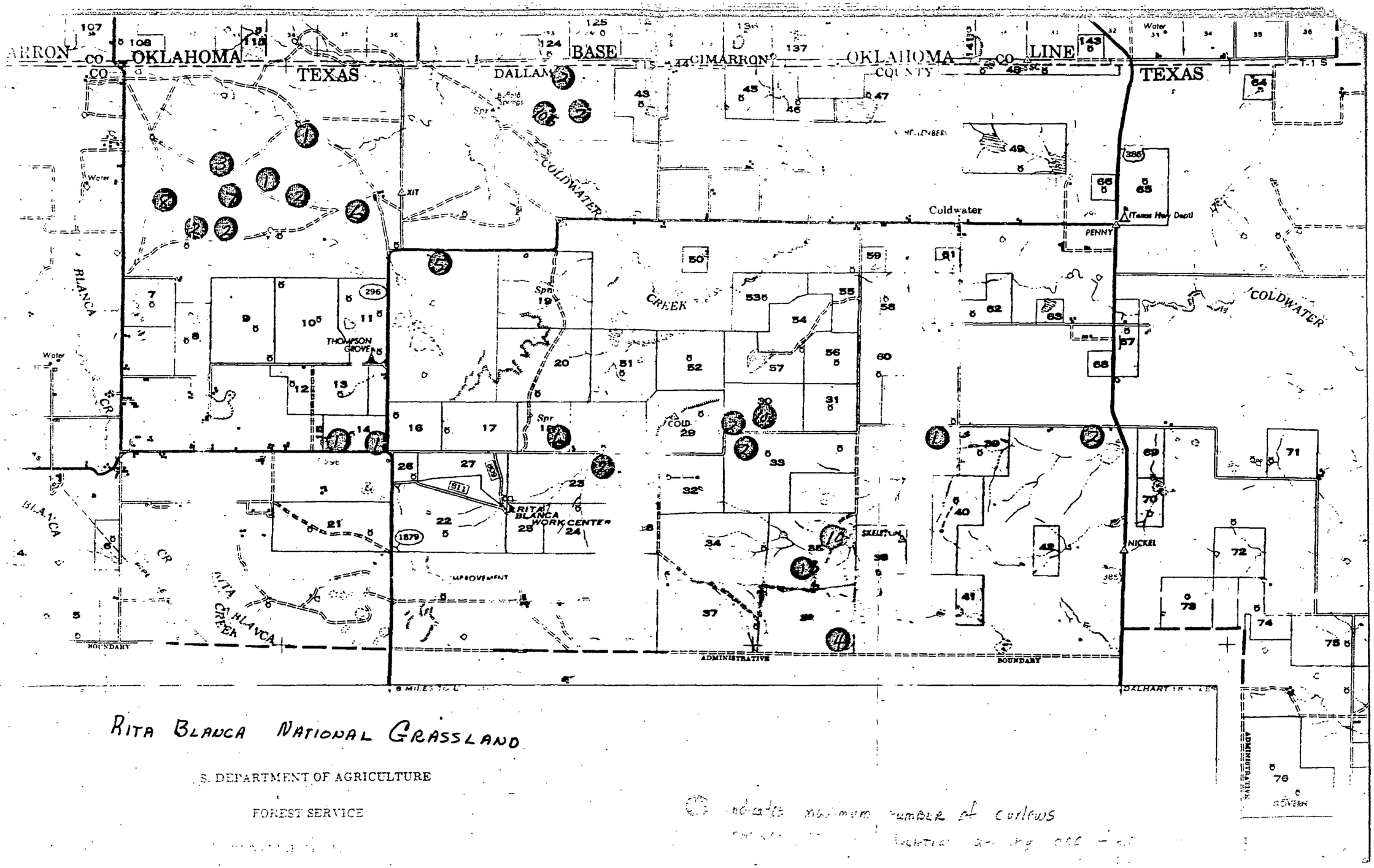


Figure 13. Adult female curlew in dense stand of squirreltail, indicative of disturbed areas. Note the extreme length of bill, typical of female curlews. June, 1977. Baca Co., CO.

Figure 14. A young fledgling curlew observed feeding in a cut wheatfield with another chick and an adult male. July, 1977. Baca Co., CO

Appendix D

MAPS



RITA BLANCA NATIONAL GRASSLAND

U.S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE

indicate maximum number of curlews

20′

R.44W. R.43W.

T.30S.

T.31S.

T.32S.

T.33S.

T.34S.

T.35S.

20′

10′

37°

TO JOHNSON CITY, KAN

TO ELKHART, KAN

Walsh

Vilas

EATON

SOUTH ATCHISON TOPEKA AND SANTA FE

PARALLEL

BM 4158

BM 4048

BM 3956

BM 3943

BM 3906

BM 3893

Dry Creek

Creek

WEST GUIDE MERIDIAN

FIFTH AUXILIARY

ARROYO

SAND

SANDHILL 4122

BLOWOUT 4175

WYCHE

NORTH FORK CIMARRON RIVER

PIPELINE

GASLINE 4152

LOWDER 4146

SUNFLOWER 4094

Gravel Pit

Cem

Well

Wells

Gas

13B

17A

17Bw

17BwS

17Be

17D

1M

1G

1F

1Ae

1J

1N

1B

1Aw

1P

100

160

546

545

DICATES MAXIMUM NUMBER OF
BLEWS OBSERVED AT THIS
ATION AT ANY ONE TIME
RK

R.48W. R.47W. TO LAMAR R.46W. R.45

Springfield
CARRIZO
BM 4351
SANTA FE
TOPEKA AND ATCHISON
SIXTH
STANDARD
Pritchett
PRITCH
Headquarters
SPRING
UHF Tower
COTTRELL
Well
PIPELINE
Radio Tower
CSU SOUTHEASTERN COLORADO BRANCH EXPERIMENT STATION
Lone Rock
Draw
Fork
South
Cem
MILLER 4732
Relay Station
Arroyo
SAND ARROYO
Edler
Pumping Station
Picture Canyon
Ute Canyon
BM 4339
Campo
TO KENTON.
COLORADO